Expanded Capacity for Modeling Energy Efficiency in the Southeast:

Final Project Report

By:

Marilyn A. Brown, Benjamin Staver, and Alexander Smith

School of Public Policy
Georgia Institute of Technology

http://www.cepl.gatech.edu

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Project Rationale

Across the Southeast, the expansion of utility-based energy efficiency programs is under active consideration, particularly in the proceedings of public service commissions. Programs in Arkansas and North Carolina have been expanding rapidly, achieving savings of as much as 0.7% of annual sales, with 1% in sight. The Tennessee Valley Authority has built a virtual 1,070 MW power plant from energy efficiency and demand response. Mississippi and Louisiana have recently adopted rules to begin ramping up with “quick start” programs. Everywhere, the same key questions are being discussed.

- How do the costs of energy efficiency programs compare to the benefits?
- How does the levelized cost of energy saved compare to the levelized cost of supply-side alternatives?[1]
- What is the impact of the expansion of programs on the bills and rates of customers, both participants and non-participants?
- What is the impact of the programs on the earnings and return on equity (ROE) of utilities?
- What kinds and amounts of compensation to the utilities will assure fair earnings and ROE going forward?

Effective public oversight of utility energy efficiency programs requires accurate and accessible information relevant to stakeholder concerns. The ability to produce such information is limited among non-utility stakeholders in the Southeast because existing impact assessment and forecasting tools tend to have limited accessibility to stakeholders, inaccuracies because they do not represent the full impacts of energy efficiency programs, and limited relevance in terms of addressing key stakeholder concerns. Discussions of energy efficiency also tend to be highly dependent upon utility-provided information. Enhanced modeling capacity would allow more sophisticated and engaged involvement of a broader range of stakeholders.

This summary report describes the participatory process that began with the creation of an advisory group, the review of available tools, the creation of a new tool (GT-DSM) that provides an expanded modeling capacity for stakeholders in the Southeast, and the GT-DSM manual. The report ends with a discussion of possible productive future directions and ways of institutionalizing the tool.

Advisory Group

An advisory group was created for this project to counsel the project team on the review of available tools and the creation of a new tool. The project’s advisory group is composed of experts, advocates, regulators, and utility industry staff. The group participated in five conference calls where progress on the project was presented and feedback and advice was

[1] Background on the concept and estimation of the levelized cost of energy saved can be found in Gellings, et al (2006) and Wang and Brown (2014).

solicited. Many advisory group members also engaged in lengthy additional discussions with the Georgia Tech team, focused on specific modeling issues.

- **U.S. Department of Energy (DOE) and DOE National Labs:**
  - ✓ Katrina Pielli, DOE Office of Energy Efficiency and Renewable Energy
  - ✓ Andy Satchwell, Chuck Goldman and Peter Cappers, Lawrence Berkeley National Laboratory
  - ✓ Stan Hadley, Oak Ridge National Laboratory
- **Utility Companies:**
  - ✓ Michelle Wagner and Jeff Smith, Georgia Power Company
  - ✓ Brian W. Cole, Ashlie Ossege, Tom Wiles, and Jared Lawrence, Duke Energy
- **Regulators:**
  - ✓ Jamie Barber, Georgia Public Service Commission staff
    Jack Floyd and Bob Hinton, North Carolina Utilities Commission staff
  - ✓ Tim Woolf, ex-commissioner on the Massachusetts Department of Public Utilities, currently working with Synapse Energy Economics
- **Engineering Consulting Firms, Think Tanks, and Environmental Groups:**
  - ✓ Mandy Mahoney and Jenah Zweig, Southeast Energy Efficiency Alliance
  - ✓ Natalie Mims and John Wilson, Southern Alliance for Clean Energy
  - ✓ Tom Osterhus, Integral Analytics
  - ✓ Patricia Thompson, Sage-View

Review of Current Tools

This review began with an in-depth analysis of two tools, including development and analysis of the impacts of EE scenarios within each tool:

(1) The Energy Efficiency Benefits Calculator was developed by the U.S. Environmental Protection Agency and Energy and Environmental Economics, Inc. (EPA, 2012). The tool was part of the interagency participatory process leading to the National Action Plan for Energy Efficiency, http://www1.eere.energy.gov/seeaction/pdfs/ratyer_efficiency_conceptpaper.pdf.

Lawrence Berkeley National Laboratory subsequently developed an enhanced version of the Calculator and has used it to produce studies of energy efficiency policy options, including a seminal study in 2009 of a prototypical Southwest utility (Cappers et al., 2009).

(2) The Bill Impact Model was developed by the Department of Public Utilities of Massachusetts (MA-DPU, 2010). It addresses many of the same issues as the EPA Energy Efficiency Benefits Calculator and similarly can show bill and rate impacts over time. It has the particular strength of being able to show the relative impacts on both participants and nonparticipants in programs, as levels of participation and energy savings change.

Following this detailed examination of these two tools, the review then expanded to a larger suite of tools, listed below along with their authors:

- Nova Scotia Bill Impact Module (Synapse Energy Economics)
- Energy Efficiency and Pollution Controls calculator (American Council for an Energy Efficient Economy) (Hayes and Young, 2013)

- Cost-Benefit Analysis Test Summary Calculator (Snuller Price of Energy & Environmental Economics)
- The Oak Ridge National Laboratory Financial Model (ORFIN) (Hadley, 1996)
- Integral Analytics Suite – DSMore, IDrop, LoadSEER (Tom Osterhus of Integral Analytics)
- Electricity Distribution Evaluator, AKA "EDGE" (Rocky Mountain Institute)

We evaluated these tools using three metrics: **accessibility** of the model to stakeholders, **accuracy** in representing the impacts of the program, and **relevance** to stakeholder concerns. To meet the last criterion, for instance, it was important to be able to estimate impacts on participant and nonparticipant utility bills as well as rates. The advisory group provided input on the specific components to consider for each metric.

A copy of the "Review of Current Tools" can be found at: http://cepl.gatech.edu/drupal/sites/default/files/GT-Current_Tool_Report-Final.pdf#overlay-context=node/69

GT-DSM Tool

Once the study of existing tools was completed, a new tool was developed, guided by the desire for accessibility, accuracy, and relevance. This new tool integrated methods from existing tools as well as expanding on the level of analysis in certain areas that were identified as lacking by the advisory group. The tool was advanced iteratively through technical reviews with the full advisory group and with some members individually. The areas of expansion included fuel cost impacts, capital investment deferrals, and potential impacts of high-consumption participants. The new tool relies strictly upon publicly available information for its inputs, runs in MS Excel, and is capable of modeling key impacts to both utility firms and ratepayers. The tool is illustrated using information on energy-efficiency programs being proposed by the Georgia Power Company (Georgia Power Company, 2012a, 2013).

The model is laid out in Sectors that cover the impacts of the EE program to customers and the impacts of the EE program to the utility. The model also summarizes these impacts in a Cost-Benefit Analysis (CBA) Sector. Within each Sector there are various Modules that cover different categories of impacts from energy efficiency programs. Modules may also contain various Sub-Modules that are targeted at specific aspects of energy efficiency program impacts. Users may select which Modules and Sub-Modules to use in order to produce a useful analysis from the tool.

The Customer Sector focuses on the electricity rate and utility bill and how an energy efficiency program affects them. To this end, the Customer Sector has two modules: the Rate Impact Module and the Bill Impact Module. In the Customer Sector, there are also multiple iterations of all of the Modules to allow analysis of independent energy efficiency programs for multiple Customer Classes for one utility.

The Utility Sector focuses on the revenue and costs to the utility and how an energy efficiency program affects those revenues and costs. To this end, the Utility Sector has three modules: the

Performance Incentive Module, the Deferred Capital Investment Module, and the Rate Case Module.

The CBA module produces estimates of four cost-effectiveness tests for utility-operated energy efficiency, which account for different stakeholder perspectives on the energy efficiency program. These are described and discussed in detail in the "California Standard Procedure Manual" and the International Performance M&V Manual (International Performance Measurement & Verification Protocol Committee, 2002; State of California Governor's Office of Planning and Research, 2002), and they are described below, along with illustrative questions provided by the National Action Plan for Energy Efficiency (NAPEE) (2008) that can be answered by each test.

- The Ratepayer Impact Measure (RIM) test identifies the extent to which electric power rates will increase due to the deployment of a given resource option. It answers the questions: What is the impact of the energy efficiency project on the utility's operating margin? Would the project require an increase in rates to reach the same operating margin?
- The Participant Cost Test (PCT) weighs the costs and benefits to those adopting distributed resource options or participating in utility DSM programs. It answers the questions: Is it worthwhile for a customer to install energy efficiency? Is the customer likely to want to participate in a utility program that promotes energy efficiency?
- The Program Administrator Cost Test (PAC or PACT) weighs the costs and benefits to the utility firm seeking to deploy the given resource option or program. It answers the questions: Do total utility costs increase or decrease? What is the total of customer bills required to keep the utility whole (the change in revenue requirement)?
- The Total Resource Cost Test (TRC) estimates the net benefits of the resource option to both the utility firm and its ratepayers. It answers the questions: What is the regional benefit of the energy efficiency project including the net costs and benefits to the utility and its customers? Are all of the benefits greater than all of the costs (regardless of who pays the costs and who receives the benefits)? Is more or less money required by the region to pay for energy needs?

This tool can evaluate a wide range of proposed programs and alternative scenarios of utility and customer characteristics. It can also assist with resource planning by evaluating demand-side energy resources using levelized cost estimates that are comparable to the metrics used in evaluating supply-side energy resources.

GT-DSM Manual

The manual for the GT-DSM tool contains three main parts. The first is a description of the inputs. The second section contains brief descriptions of the important calculations carried out within the tool. The final section contains descriptions of the outputs from the tool.

The purpose of this manual is to provide an easy reference for information on the GT-DSM tool. The manual also includes a more in-depth description of the components and the terminology as well as the methods chosen for calculations, making the tool more accessible than it would be as a stand-alone spreadsheet.

Finally, the tool provides guidance on where users might acquire estimates of various data and statistics for customizing GT-DSM to their needs. Types of publicly available data sources recommended in the manual include:

- SEC 10-K forms,
- Survey form EIA-861 (EIA, 2011),
- Utility annual reports (Georgia Power Company, 2012a; Southern Company, 2013),
- Estimates of energy efficiency potential (e.g., Georgia Power Company, 2012b), and
- Public Service Commission dockets and filings (e.g., Georgia Power Company, 2012c, 2012d).

Productive Future Directions

In looking to the future, three issues emerge: (1) the cost and practicality of institutionalizing the GT-DSM tool, (2) opportunities to put the tool to productive use, and (3) ways to enhance future versions of the tool.

Institutionalizing the GT-DSM can be achieved through many different strategies, such as conducting workshops, creating user groups and assistance services, and further documenting new additions to the tool.

Opportunities to put the tool to productive use are numerous. In addition to the over-arching questions listed on page 1, GT-DSM could be used to answer many pressing and important questions related to the deployment of utility-funded energy efficiency programs in the Southeast, such as:

- How do the different program evaluation approaches used across states in the Southeast impact the CBA tests for energy efficiency programs?
- How big a difference do different decoupling rules, such as per-customer revenue decoupling, Lost Revenue Adjustment Mechanisms (LRAM), and straight fixed variable rates, make on the various CBA tests?[2]
- What are the impacts from the deferral of capital costs in terms of foregone plant environmental clean-up costs?
- How big an impact does the on-peak concentration of savings from an energy efficiency program have on CBA tests?

Finally, there are many ways to advance future versions of GT-DSM. Possibly the most impactful advancement to GT-DSM would be to customize the tool to the evaluation of utility incentive programs for demand response and customer-owned solar photovoltaics. More

[2] Background on decoupling can be found in NAPEE (2007), Satchwell, et al. (2011), ELCON, 2007, and Kihm (2009).

modest improvements would include adding the societal cost test to the suite of four CBA cost tests currently modeled in the tool. The societal cost test generally involves the inclusion of benefits from reduced pollution. The treatment of other non-energy benefits and costs could also be incorporated into GT-DSM. The impact of deferred capital expenditures including the installation of environmental controls could be treated in a more comprehensive way, for example, by including considerations of emissions compliance goals. Finally, different discount rates, planning horizons, and assumptions about the longevity and persistence of energy efficiency measures could be enabled through further development of GT-DSM.[3]

The portal for this project, the GT-DSM tool and its manual is the website for the Georgia Institute of Technology's Climate and Energy Policy Lab at:

http://cepl.gatech.edu/drupal/node/69.

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[3] Background on the persistence of energy efficiency measures can be found in NREL (2013).

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